

# PATENT SPECIFICATION

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## (54) MOULDING OF POLYMERIC MATERIAL

(71) We, INSTITUTE po  
 METALOZNANIE i TECHNOLOGIA na  
 METALITE, of 53, Chapaev Str., Sofia 13,  
 Bulgaria, a Research Institute organized  
 under the Laws of Bulgaria, do hereby  
 declare the invention, for which we pray  
 that a patent may be granted to us, and the  
 method by which it is to be performed, to be  
 particularly described in and by the  
 following statement:—

This invention relates to a method of  
 producing an article having a smooth non-  
 cellular skin and a cellular core and also  
 relates to an injection nozzle for use in  
 carrying out the method.

According to one aspect of the present  
 invention there is provided a method of  
 producing an article having a smooth, non-  
 cellular skin and a cellular core by injection  
 moulding of a polymer material containing  
 a blowing agent, the method comprising the  
 steps of:

(a) injecting a first batch of the material  
 through a nozzle into a mould at a  
 temperature below that at which foaming  
 takes place, and

(b) injecting a second batch of the  
 material through the nozzle into the mould  
 at a temperature above that at which  
 foaming takes place,  
 whereby the first batch forms the skin and  
 the second batch forms the core of the  
 article.

According to another aspect of the  
 present invention there is provided an  
 injection nozzle for injecting a polymer  
 material into a mould, the nozzle including  
 a body having a duct for conveying the  
 material to be injected, which duct contains  
 an elongate electric heating element which  
 is disposed coaxially with the duct.

The present invention also provides  
 injection moulding apparatus including an  
 injection nozzle in accordance with the said  
 second aspect.

The present invention may be carried  
 into practice in a number of ways, but one  
 specific embodiment will now be described,  
 by way of example only, with reference to  
 the accompanying drawings, in which:

Figure 1 is a sectional view through an  
 injection nozzle, and

Figures 2 to 5 show sectional views  
 through a mould at different stages during  
 an injection moulding process.

Figure 1 shows an injection nozzle  
 including a body consisting of two  
 electrically conductive components 1 and 5,  
 which are connected together by a nut 4  
 and are electrically insulated from each  
 other by two insulating rings 3. The nozzle  
 affords a through duct coaxial with which  
 there is disposed an electric heating  
 element 2. One end of this element 2 is  
 welded to the component 1, while the other  
 end is welded to the component 5. Current  
 supply to the heating element can be  
 switched on or off at a supply and control  
 block 7 which is connected to a current  
 source. The nozzle can be attached to the  
 end of a plasticating and injection unit 6 of  
 an injection moulding machine.

The moulding of an article, using the  
 nozzle shown in Figure 1, will now be  
 described with reference to Figures 2 to 5.

A polymer melt, containing a blowing  
 agent, is heated to a temperature lower than  
 that at which foaming takes place, i.e. lower  
 than the decomposition temperature of the  
 blowing agent, and a first batch 9, of  
 unfoamed material, is injected into the  
 mould cavity of a mould 8 (Figure 2). After  
 the required quantity of material necessary  
 for the formation of a smooth non-cellular  
 skin has been introduced into the mould,  
 the electric heating element 2 in the nozzle  
 is switched on, thus abruptly increasing the  
 temperature of the polymer melt which is  
 flowing through the nozzle to a temperature  
 above that at which foaming occurs, i.e.  
 above the decomposition temperature of  
 the blowing agent, and a second batch 10,  
 this time of foamed material, is injected into  
 the mould (Figures 3 and 4). Heating  
 continues until enough foamed material has  
 been introduced into the mould to form the  
 cellular core. Towards the end of the filling  
 process the electric heating element 2 is  
 switched off in order to reduce the  
 temperature of the material below the

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decomposition temperature of the blowing agent, and a third batch 11, again of unfoamed material is injected into the mould, so as to obtain a non-cellular skin in the area of the sprue (Figure 5). The penetration of the material into all parts of the mould cavity takes place under the action of the pressure of the decomposition gas products, formed during the foaming of the material of the core.

**WHAT WE CLAIM IS:—**

1. A method of producing an article having a smooth, non-cellular skin and a cellular core by injection moulding of a polymer material containing a blowing agent, the method comprising the steps of:

(a) injecting a first batch of the material through a nozzle into a mould at a temperature below that at which foaming takes place, and

(b) injecting a second batch of the material through the nozzle into the mould at a temperature above that at which foaming takes place,

whereby the first batch forms the skin and the second batch forms the core of the article.

2. A method as claimed in claim 1, including the further step, after injecting the second batch, of injecting a third batch of the material at a temperature below that at which foaming takes place to afford a non-cellular skin portion in the region where the material is introduced into the mould.

3. An injection nozzle for injecting a polymer material into a mould, the nozzle

including a body having a duct for conveying the material to be injected, which duct contains an elongate electric heating element which is disposed coaxially with the duct.

4. An injection nozzle as claimed in claim 3, in which the body comprises two electrically conductive components, each end of the heating element being connected to one respective component, the components being otherwise electrically insulated from each other, each component being provided with means for connecting it to a current source.

5. An injection nozzle substantially as specifically described herein with reference to the accompanying drawings.

6. Injection moulding apparatus including an injection nozzle as claimed in any one of claims 4 to 6.

7. A method of producing an article, the method being substantially as specifically described herein with reference to the accompanying drawings.

**HASELTINE LAKE & CO.,**  
Chartered Patent Agents,  
28 Southampton Buildings,  
Chancery Lane,  
London WC2A 1AT  
— and —  
Temple Gate House,  
Temple Gate,  
Bristol BS1 6PT.  
— and —  
9 Park Square,  
Leeds LS1 2LH.

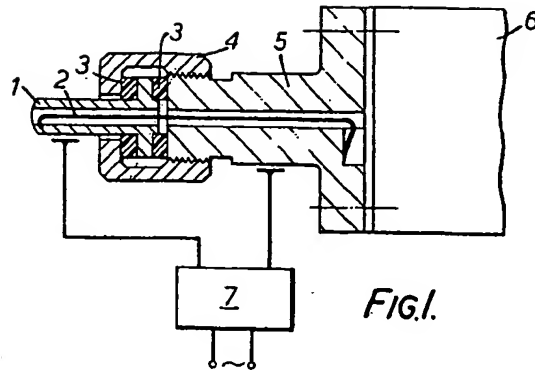


FIG. 1.

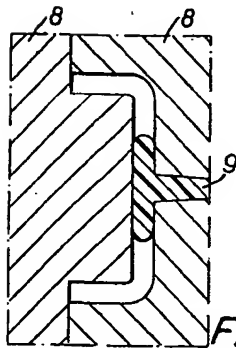


FIG. 2.

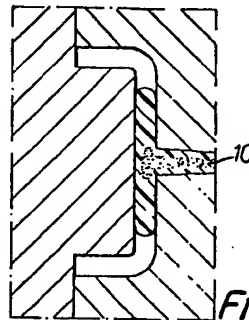


FIG. 3.

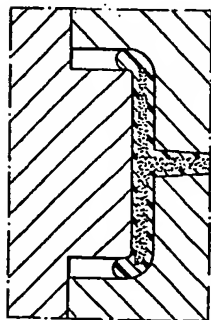


FIG. 4.

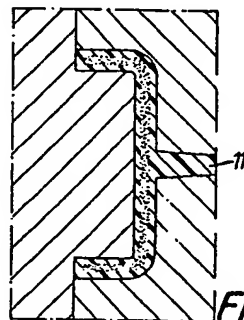


FIG. 5.